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MICHIGAN DEPARTMENT OF NATURAL RESOURCES
ENVIRONMENTAL PROTECTION BUREAU
POINT SOURCE STUDIES SECTION

Report of an
Industrial Wastewater Survey
Conducted at
TOTAL PETROLEUM
All Outfalls No. 290006
Gratiot County
Alma, Michigan
June 2-3, 1980

Survey Summary

Wastewater monitoring was performed during one twenty-four hour survey period starting Monday, June 2-3, 1980.

The results of the survey are compared to the final limitations in the facility's National Pollutant Discharge Elimination System (NPDES) Permit, No. M00021066 in Table 3. Based on this comparison, the company met its daily average permit limitation for all parameters.

The results of this survey are also compared to the company's Monthly Operating Report (MOR) results for June, 1980 in Table 3. The company reported higher loadings for suspended solids, chemical oxygen demand, and ammonia nitrogen on June 3. The company's results for pH were lower on both survey dates. The company reported no discharge of sulfide during the month while the survey results showed sulfide in all samples collected.

The composite sample at outfall 290024 (001) was split with the company for comparison of laboratory analyses. The results are shown in Table 4. The company reported higher results for COD, suspended solids and ammonia nitrogen.

Results obtained in this survey are compared to the results of the previous survey conducted in November, 1978 in Table 5.

Survey Comments

This survey was conducted in conjunction with a 96-hour continuous flow acute toxicity study.

The deep well injection and sludge storage tank were sampled. The results of the analyses are shown in Table 2.

Plant Processes

Total Petroleum, Inc. employs 350 people and operates 24 hours per day, 7 days per week, 52 weeks per year. The main product of the plant is gasoline.

Fuel oil, jet fuel, and residual fuels are also produced. Asphalt production has been discontinued. Normal production is 42,000 barrels per day. During the survey the production rate was 95-100% of normal.

Most of the crude oil is transported to the plant by pipeline and the remainder by truck. The crude oil goes through desalters before being pumped to the prefractionator and the main column crude unit. This supplies the stock charge for the fluid catalytic cracker, hydrofiners, rehenformers, bender treater, and alkylation unit. Stock is also supplied to the fluid catalytic cracker by outside refiners. This results in such petroleum products as propane, regular gasoline, no lead gasoline, jet fuel, flash solvent, mineral seal, kerosene, number 1 fuel oil and number 2 fuel oil. A new Dimersol unit uses propylene to make high octane gasoline.

The vacuum distillation unit that produced asphalt is not operated.

For further details see Figure 1 which was provided by Total Petroleum. Figure 2 is a map of the plant area.

Water Supply, Wastewater & Treatment

The plant's domestic water is supplied by the City of Alma. The domestic wastewater is discharged to the Alma sanitary sewer system. Boiler feed water is softened before use.

Cooling water is recycled through three cooling towers and is supplemented by city water and water from three company wells.

The majority of the process water is used in extracting salts from the crude oil and for heating or cooling in heat exchangers. The process water that is caustic or high in metals, phenols, ammonia, and sulfates is disposed of through the main or the standby deep well. The rest of the process water, boiler blowdown, softener backwash, and the drainage from the plant goes through an oil and water separator. The oil is skimmed off and pumped back through the plant. Water from the separator is treated in a series of seven lagoons: primary settling, aeration, settling and polishing (four lagoons). The lagoon effluent, outfall 001, is discharged into County Drain 52. The retention time in the system varies from 25 to 40 days (Figure 2). There are three additional ponds used in case of an emergency spill.

Survey Procedure

The flow and samples were obtained as follows:

Outfall	Flow Measurement	Sampling
290024 (001)	Company 90° v-notch weir and survey crew installed water level recorder.	Automatic air activated composite & individual grab.
Deep Well Injection	None	Individual grab.
Oil Sludge	None	Individual grab.

A water level recorder provides a continuous account of the liquid level or head above the crest of a weir or through a flume. A head versus time graph is obtained for the duration of the survey period. The total volume of wastewater over the weir or through the flume during the survey period is computed from the graph.

An automatic sampler composites samples at timed intervals. Samples may be proportional to the instantaneous flow over the weir or through the flume.

Polychlorinated biphenyl (PCB) and sulfide composite samples are collected by the grab composite method.

An individual grab is a single instantaneous sample.

Samples were analyzed by the Environmental Protection Bureau Laboratories located in Lansing.

Samples were preserved according to Table 6. The results of the physical, chemical and bacteriological analyses are presented in Tables 1 & 2.

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Table 1. Analyses of composite sample.

Outfall	290024 (001)	
Survey Period	From	6-2-80 - 1135
	To	6-3-80 - 1135
Computed flow rate ¹ (M ³ /day)	1,890	
Highest flow rate (M ³ /day)	2,260 - 6-3-80 @ 1111	
Lowest flow rate (M ³ /day)	1,650 - 6-2-80 @ 2206	
	<u>mg/l</u>	<u>kg/day</u>
5-day BOD	9.8	19
COD	130	250
TOC	37	70.
Suspended solids	11	21
Dissolved solids	2,324	4,390
Nitrite & nitrate nitrogen-N	0.23	0.43
Ammonia nitrogen-N	2.0	3.8
Kjeldahl nitrogen-N	4.5	8.5
Total phosphorus-P	0.27	0.51
Orthophosphates-P	< 0.01	--
Chlorides (Cl)	740	1,400
Sulfide (S)	0.34	0.64
Cyanides (CN)	< 0.005	--
Free cyanide (CN)	< 0.005	--
Phenols	0.013	0.025
Total cadmium (Cd)	< 0.02	--
Total chromium (Cr)	< 0.05	--
Total copper (Cu)	< 0.02	--
Total nickel (Ni)	0.07	0.1
Total lead (Pb)	< 0.05	--
Total zinc (Zn)	< 0.05	--
Total cobalt (Co)	< 0.05	--
	<u>ug/l</u>	
PCB 1242	< 0.1	--
PCB 1254	< 0.1	--
PCB 1260	0.87	1.6

1 - Flow rates used in the computation of kg/day.
To obtain MGD multiply M³/day by 0.0002642
To obtain lbs/day multiply kg/day by 2.205

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Table 2 Analyses of grab samples.

Date	Time	Flow ¹ M ³ /day	Temp. ² °C	pH ² S.U.	O&G I.R. mg/l	O&G Grav. mg/l	COD mg/l	TOC mg/l	Sulfide mg/l	BOD mg/l	Chloride mg/l	Nitrite & nitrate nitrogen mg/l	Ammonia nitrogen mg/l
290024 (001)													
6-2-80	1800	1780	18	8.4	1	3	--	--	0.61	12	740	0.07	2.0
6-3-80	0815	2080	17	7.9	2	4	120	25	0.37	9.8	750	0.07	2.1
6-3-80	1135	2250	18	8.0	--	--	130	40	--	--	--	--	--
Deep Well													
6-2-80	1600	--	--	--	--	--	--	--	2,200	--	--	--	--
<u>mg/kg</u>													
Sludge													
6-2-80	1600	--	--	--	610,000	--	--	--	--	--	--	--	--
		Kjeldahl nitrogen mg/l	Total phosphorus-P mg/l	Ortho- phosphates-P mg/l	Susp. solids mg/l	Total diss. solids mg/l	Total cadmium mg/l	Total chromium mg/l	Total copper mg/l	Total nickel mg/l	Total lead mg/l		
290024 (001)													
6-2-80	1800	3.7	0.26	< 0.01	--	--	< 0.02	< 0.05	< 0.02	0.07	< 0.05		
6-3-80	0815	3.7	0.24	< 0.01	10	2348	< 0.02	< 0.05	< 0.02	0.07	< 0.05		
6-3-80	1135	--	--	--	14	2368	--	--	--	--	--		
Deep Well													
6-2-80	1600	--	--	--	--	--	< 0.02	< 0.05	< 0.02	0.30	< 0.05		
<u>mg/kg</u>													
Sludge													
6-2-80	1600	--	--	--	--	--	--	J 70	70	170	70		

- 1 - Flow at time of grab sampling.
 2 - Values determined in the field at time of sampling.
 J - Estimated value, value may not be accurate.

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Table 2 (continued)

Date	Time	Total zinc mg/l	Total cobalt mg/l	Total cyanide mg/l	Free cyanide mg/l	Phenol mg/l	Benzene ug/l	Ethylene Dibromide ug/l	Napthalene ug/l	Dichloro- propane ug/l	Toluene ug/l
290024 (001)											
6-2-80	1800	< 0.05	< 0.05	< 0.005	< 0.005	--	< 50	< 10	< 1	< 200	--
6-3-80	0815	< 0.05	< 0.05	< 0.005	< 0.005	0.028	< 50	< 10	1	< 200	--
6-3-80	1135	--	--	--	--	0.023	--	--	--	--	--
Deep Well											
6-2-80	1600	< 0.05	< 0.05	4.5	--	--	1700	< 10	--	--	2600
<u>mg/kg</u>											
Sludge											
6-2-80	1600	380	< 10	--	--	--	U	U	--	--	--
		PCB 1242 ug/l	PCB 1254 ug/l	PCB 1260 ug/l							
Deep Well											
6-2-80	1600	< 2	< 0.2	1,300							
<u>ug/kg</u>											
Sludge											
6-2-80	1600	< 10,000	< 10,000	< 10,000							

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Table 3 Comparison of survey results with the facility's NPDES Permit and Monthly Operating Report.

Parameter (Unit)	NPDES Permit Final Limitations		June Monthly Operating Report				Survey Results ¹
	Daily Average	Daily Maximum	Monthly Average	Monthly Maximum	6-2-80	6-3-80	
290024 (001)							
Flow (M ³ /day)	--	--	1,690	2,040	1,830	2,040	1,890
Susp. solids (kg/day)	79	134	36	61	--	61	21
Oil & Grease (mg/l)	--	10	3	5	3	2	(3, 4)
Phenol (kg/day)	0.8	1.6	0.035	0.063	--	0.039	0.025
Sulfide (kg/day)	0.6	1.5	0	0	--	--	0.64
Temperature (°C)	--	--	21	26	--	--	(18, 17, 18)
COD (kg/day)	847	1630	324	522	--	441	250
pH (S.U.)	not <6.5 nor >9.5		min. 6.3	8.3	7.7	7.4	(8.4, 7.9, 8.0)
Ammonia nitrogen-N (kg/day)	66	145	3	7.3	--	7.3	3.8
BOD ₅ (kg/day)	72	163	20	27	--	24	19
May 1 through October 31							
TOD ₂ (kg/day)	204	--	42	69.9	--	68	45
(lb/day/cfs)	--	12.6	0.75	1.82	--	--	--

1 - Survey results are for the composite sample. Grab sample ranges are shown in parentheses ().

2 - TOD = 1.46 BOD₅ x 4.57 NH₃-N
 To obtain MGD multiply M³/day by 0.0002642
 To obtain lbs/day multiply kg/day by 2.205

$$BOD_5 \frac{kg}{day} = 120$$

$$284 \frac{kg}{day} =$$

$$NH_3 \frac{kg}{day} = 4$$

Table 4 Comparison of the laboratory analytical results obtained by Total Petroleum and the Environmental Protection Bureau from the split composite samples.

Outfall	290024 (001)
	Total Petroleum mg/l
5-day BOD	12
COD	175
Suspended solids	30
Ammonia nitrogen-N	3.5
Phenols	0.019
	E.P.B. mg/l
	11
	2.0
	0.013

Table 5 Comparison of the previous survey results with the results obtained in this survey at Total Petroleum, Alma.

Outfall	290024 (001)
Survey Date From To	11-13-78 6-2-80
Flow Rate (M ³ /day)	2,670 1,890
	mg/l
5-day BOD	13 9.8
COD	93 130
Suspended solids	9 11
Dissolved solids	1,500 2,324
Nitrite & nitrate nitrogen-N	0.10 0.23
Ammonia nitrogen-N	2.5 2.0
Organic nitrogen-N	2.3 2.5
Total phosphorus-P	0.22 0.27
Chlorides (Cl)	540 740
Sulfide (S)	< 0.05 0.34
Cyanides (CN)	< 0.01 < 0.005
Phenols	0.020 0.013
Total zinc (Zn)	0.02 < 0.05

Table 6 Sample Preservation

Parameter	Preservative
COD & TOC	10 drops conc. H_2SO_4 /250 ml (to pH <2).
Cyanide & Phenolics	Dechlorinate with ascorbic acid (if needed). 10 drops 10 N NaOH (to pH 12)/250 ml.
Total Metals	2 ml 1:1 HNO_3 /250 ml (to pH <2).
Oil & Grease	10 drops conc. H_2SO_4 /250 ml (to pH <2).

All samples cooled to 4°C and preserved upon collection and chain of custody maintained.

Survey by: Peter Ostlund, General Engineer
Maria Ficek, Water Quality Technician
Kent Mottinger, Water Quality Technician

Contact with Management: Patrick Lincoln

Certified Operator: Bernie Shaver

Hydrocarbon Analyses by: Environmental Protection Bureau Laboratory

Physical, Chemical &
Bacteriological Analyses by: Environmental Protection Bureau Laboratory

Report by: Peter Ostlund
Maria Ficek
Point Source Studies Section
Environmental Services Division
Environmental Protection Bureau
Michigan Dept. of Natural Resources

Distribution "A"
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Figure 1 Total Leonard, Inc.
Alma, Michigan

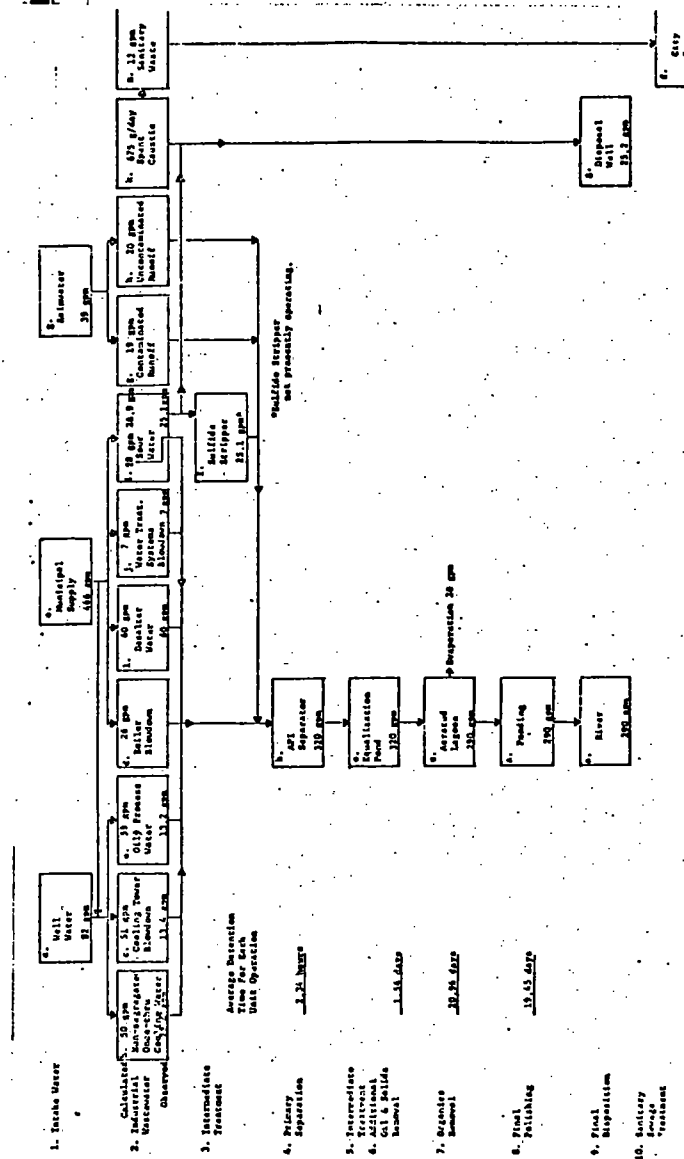


Figure 2 Total Leonard, Inc.
Alma, Michigan

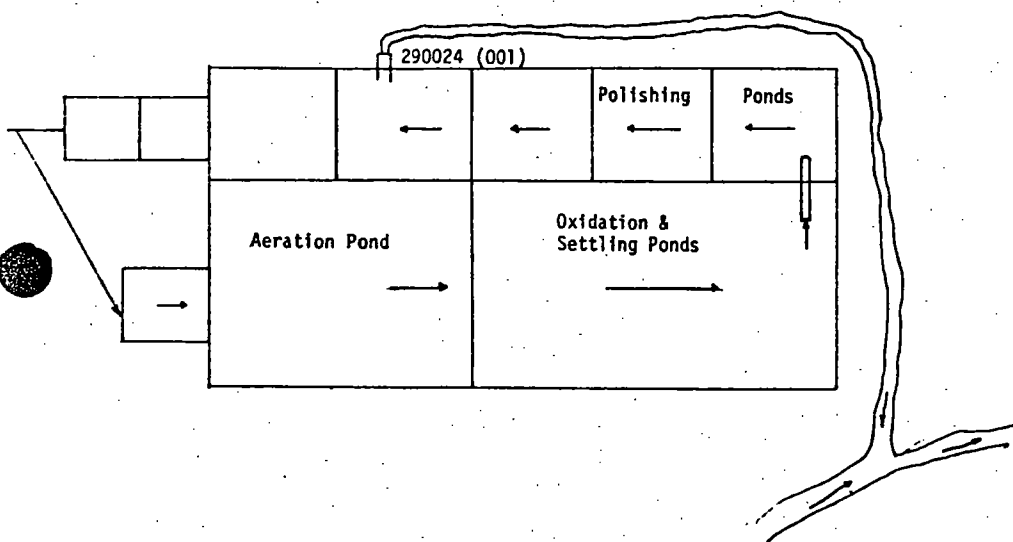
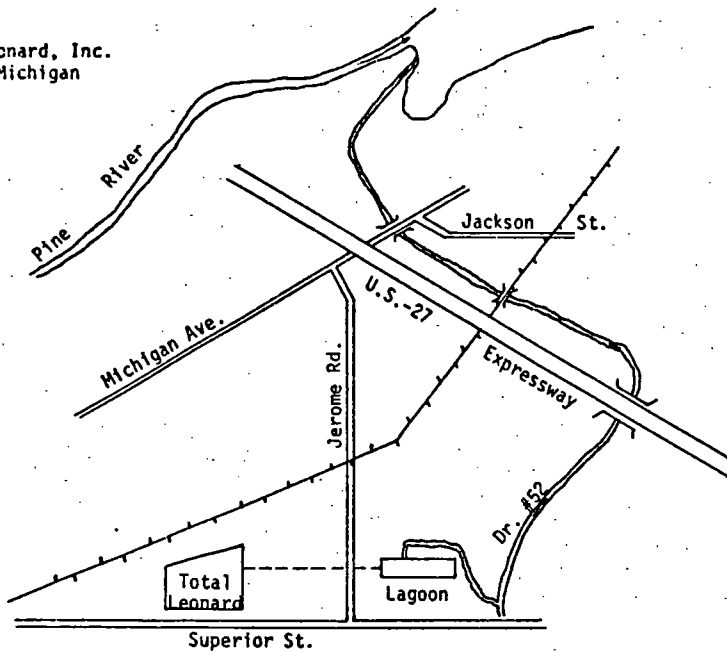


FIGURE 16

PINE RIVER
ALMA - ST. LOUIS
SAMPLING STATIONS

